Canadian Centre for Occupational Health and Safety

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Asthma

A Summary of the Occupational Health Concern

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ASTHMA

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ASTHMA--A SUMMARY OF THE OCCUPATIONAL HEALTH CONCERN

This publication was prepared as a source of information for health and safety committees and others with an interest in understanding and reducing the occupational risk of asthma.

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TABLE OF CONTENTS

1. WHAT IS OCCUPATIONAL ASTHMA? 1

2. HOW DOES IT DEVELOP? 1

   Allergic Asthma 1
   Non-Allergic Asthma 2

3. HOW LONG DOES IT TAKE TO DEVELOP? 2

4. HOW COMMON IS IT? 3

5. WHAT ARE THE PREDISPOSING FACTORS? 3

6. HOW DOES THE DOCTOR KNOW IF A WORKER HAS ASTHMA? 3

7. HOW CAN WE CONTROL OCCUPATIONAL ASTHMA? 4

8. HOW CAN WE PREVENT OCCUPATIONAL ASTHMA? 4

9. WHAT OCCUPATIONS ARE AT RISK? 4

FURTHER READING 11

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1. WHAT IS OCCUPATIONAL ASTHMA?

Asthma is an obstruction of the air passages that results in difficult breathing. Occupational asthma refers to asthma that is caused by breathing in specific agents in the workplace. During an attack of asthma, air is easily inhaled, but not easily exhaled. The result is that with each inhalation, more air is trapped in the lungs which become over-stretched. Asthmatic people require visible effort to breathe. With the narrowing of the airways, the simple act of breathing becomes very difficult.

Occupational asthma is caused by an abnormal response of the body to the presence of an agent in the workplace. The abnormal response of the body, called "sensitization," develops after variable periods of workplace exposure to certain dusts, fumes or vapours.

Not all workers react with an asthmatic response when exposed to industrial agents. Asthma strikes only a fraction of workers. Asthmatic attacks can be controlled either by ending exposure to the agent responsible or by medical treatment.

2. HOW DOES IT DEVELOP?

Asthma is triggered in several ways and most of them are not completely understood. For simplicity, we categorize them into two groups: allergic and non-allergic.

Allergic Asthma

Allergic asthma involves the body's immune system. This defense system consists of a series of complex elements that protect the body from harm caused by alien substances or microbes. Among the most important elements of the defense mechanism are special proteins called "antibodies." These are produced when the human body contacts an alien substance or microbe. Antibodies react with substances or microbes to destroy them. Antibodies are often very selective, acting only on one particular substance or type of microbe.

But antibodies can also respond in a wrong way and cause allergic disorders such as asthma. After a period of exposure to an industrial substance, either natural or synthetic, a worker may start producing too many of the antibodies called "immunoglobulin E" (IgE). These antibodies attach to specific cells in the lung in a process known as "sensitization."

When re-exposure occurs, the lung cells with attached IgE antibodies react with the substance. This reaction results in the release of substances such as "histamine." Histamine provokes the contraction of some muscles in the airways. This causes the narrowing of air passages which is characteristic of asthma.

Non-Allergic Asthma

Following repeated exposure to an industrial chemical, substances such as histamine are released in the lungs. Again, the histamine causes narrowing of air passages typical of asthma. The reasons for such release are still not clear because no antibody reaction seems to be involved.

3. HOW LONG DOES IT TAKE TO DEVELOP?

There is no fixed period of time in which asthma can develop. Asthma as a disease may develop from a few weeks to many years after the initial exposure. Studies carried out on some platinum refinery workers show that in most cases asthma develops in 6 to 12 months. But it may occur within 10 days or be delayed for as long as 25 years.

Analysis of the respiratory responses of sensitized workers has established three basic patterns of asthmatic attacks, as follows:

Immediate - typically develops within minutes of exposure and is at its worst after approximately 20 minutes; recovery takes about 2 hours.

Late - can occur in different forms. It usually starts several hours after exposure and is at its worst after about 4 to 8 hours with recovery within 24 hours. However, it can start 1 hour after exposure with recovery in 3 to 4 hours. In some cases, it may start at night, with a tendency to recur at the same time for a few nights following a single exposure.

Dual or Combined - is the occurrence of both immediate and late types of asthma.

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4. HOW COMMON IS IT?

The frequency of occupational asthma is unknown, although various estimates are available. In Japan, 15 percent of asthma in males is believed to be occupational. In the United States, 2 percent of all cases of asthma are thought to be of occupational origin. The number of cases of occupational asthma varies from country to country and from industry to industry. About 6 percent of animal handlers develop asthma due to animal hair or dust. Asthma among workers processing "proteolitic enzymes" of "Bacillus subtilis" in the detergent industry was estimated to be between 10 and 45 percent. However, preparations of the enzymes in granulated form, which is less readily inhaled, have reduced the likelihood of asthma. Approximately 5 percent of workers exposed to isocyanates and wood dusts develop asthma.

5. WHAT ARE THE PREDISPOSING FACTORS?

Some workplace conditions seem to increase the likelihood that workers will develop asthma, but their importance is not fully known. Factors such as the properties of the chemicals, and the level and duration of exposure are obviously important. However, because only a proportion of exposed workers are affected, factors peculiar to individual workers can also be important. Such factors include the ability of some people to produce abnormal amounts of IgE antibodies. The contribution of cigarette smoking is not known. But smokers are generally more likely than non-smokers to develop respiratory problems.

6. HOW DOES THE DOCTOR KNOW IF A WORKER HAS ASTHMA?

Sufferers from occupational asthma experience attacks of difficult breathing, tightness of the chest, coughing, and breath sounds such as wheezing, which is associated with air-flow obstruction. Such symptoms should raise the suspicion of asthma.

Specific blood tests indicating the presence of IgE antibodies can be useful, though not every case of occupational asthma involves the system that produces these antibodies. Lung function tests can help to confirm the disease. However, some patients with occupational asthma may have normal lung function. Some tests, such as bronchial provocation tests, can

demonstrate the occupational origin of asthma. They identify the agent responsible when the cause is uncertain. But they involve exposing asthmatic patients to industrial agents, and they are under critical review because of the danger they might present.

7. HOW CAN WE CONTROL OCCUPATIONAL ASTHMA?

Asthmatic attacks are controlled by drugs that widen the air passages narrowed by the muscular spasm of the asthmatic reaction. If the exposure to the causal agent is not stopped, treatment will be needed continuously and the breathing problems may become permanent. People may continue to suffer from occupational asthma even after removal from exposure. For example, a follow-up study of 75 patients with asthma caused by red cedar dust showed that only half the patients recovered. The remaining half continued to have asthmatic attacks for a period of 1 to 9 years after the termination of exposure.

Dust masks and respirators can help to control workplace exposure. However, these protective devices, in order to be effective, must be carefully selected, properly fitted and well maintained. Preventing further exposure might involve a change of job. If a job change is not feasible, relocation to another area of the plant with no exposure may be essential.

8. HOW CAN WE PREVENT OCCUPATIONAL ASTHMA?

The best way to prevent occupational asthma is to replace dangerous substances with less harmful ones. Where this is not possible, exposure should be minimized through engineering controls such as ventilation and enclosures of processes.

Education of workers is also very important. Proper handling procedures, avoidance of spills and good housekeeping reduce the occurrence of occupational asthma.

9. WHAT OCCUPATIONS ARE AT RISK?

Some of the occupations where asthma has been seen are listed in the following tables. It should be noted that the lists of occupational substances and microbes which can cause asthma are not complete. New causes continue to be added. New materials and new processes introduce new exposures and create new risks.

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Table 1 - Grains, flours, plants and gums

Occupation		Agent
Bakers, millers	- - -	Wheat
Brewery chemists	- - -	Hops
Chemists, coffee bean baggers and handlers, gardeners, millers, oil industry workers, farmers	- - -	Castor beans
Cigarette factory workers	- - -	Tobacco dust
Drug manufacturers, mold makers in sweet factories, printers	- - -	Gum acacia
Farmers, grain handlers	- - -	Grain dust
Gum manufacturers, sweet makers	- - -	Gum tragacanth
Strawberry growers	- - -	Strawberry pollen
Tea sifters and packers	- - -	Tea dust
Tobacco farmers	- - -	Tobacco leaf
Woollen industry workers	- - -	Wool

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Table 2 - Animals, insects and fungi

Occupation		Agent
Bird fanciers	- - -	Avian proteins
Cosmetic manufacturers	- - -	Carmine
Entomologists	- - -	Moths, butterflies
Feather pluckers	- - -	Feathers
Field contact workers	- - -	Crickets
Fish bait breeders	- - -	Bee moths
Flour mill workers, bakers, farm workers, grain handlers	- - -	Grain storage mites, alternaria, aspergillus
Laboratory workers	- - -	Locusts, cockroaches, grain weevils, rats, mice, guinea pigs, rabbits
Mushroom cultivators	- - -	Mushroom spores
Oyster farmers	- - -	Hoya
Pea sorters	- - -	Mexican bean weevils
Pigeon breeders	- - -	Pigeons
Poultry workers	- - -	Chickens
Prawn processors	- - -	Prawns
Silkworm sericulturers	- - -	Silkworms
Zoological museum curators	- - -	Beetles

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Table 3 - Chemicals

Occupation	Agent
Aircraft fitters	Triethyl tetramine
Aluminum cable solderers	Amino-ethyl ethanolamine
Aluminum pot room workers	Fluorine
Brewery workers	Chloramine T
Chemical plant workers, pulp mill workers	Chlorine
Dye weighers	Levafix brilliant yellow, drimaren brilliant yellow and blue, cibachrome brilliant scarlet
Electronics workers	Colophony
Epoxy resin manufacturers	Tetrachlorophthalic anhydride
Foundry mold makers	Furan-based resin binder systems
Fur dyers	Paraphenylene diamine
Hairdressers	Persulphate salts
Laboratory workers, nurses, phenolic resin molders	Formalin/formaldehyde
Meat wrappers	Polyvinyl chloride vapour
Paint manufacturers, plastic molders, tool setters	Phthalic anhydride
Paint sprayers	Dimethyl ethanolamine
Photographic workers, shellac manufacturers	Ethylene diamine
Refrigeration industry workers	Freon
Solderers	Polyether alcohol, polypropylene glycol

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Table 4 - Isocyanates and metals

Occupation		Agent
Boat builders, foam manufacturers, office workers, plastics factory workers, refrigerator manufacturers, TDI manufacturers/users, printers, laminators, tinners, toy makers	- - -	Toluene diisocyanate
Boiler cleaners, gas turbine cleaners	- - -	Vanadium
Car sprayers	- - -	Hexamethylene diisocyanate
Cement workers	- - -	Potassium dichromate
Chrome platers, chrome polishers	- - -	Sodium bichromate, chromic acid, potassium chromate
Nickel platers	- - -	Nickel sulphate
Platinum chemists	- - -	Chloroplatinic acid
Platinum refiners	- - -	Platinum salts
Polyurethane foam manufacturers, printers, laminators	- - -	Diphenylmethane diisocyanate
Rubber workers	- - -	Naphthalene diisocyanate
Tungsten carbide grinders	- - -	Cobalt
Welders	- - -	Stainless steel fumes

Table 5 - Drugs and enzymes

Occupation		Agent
Ampicillin manufacturers	- - -	Phenylglycine acid chloride
Detergent manufacturers	- - -	Bacillus subtilis
Enzyme manufacturers	- - -	Fungal a-amylase
Food technologists, laboratory workers	- - -	Papain
Pharmacists	- - -	Gentian powder, flaviastase
Pharmaceutical workers	- - -	Methyl dopa, salbutamol, dichloramine, piperazine dihydrochloride, spiramycin, penicillins, sulphathiazole, sulphonechloramides, chloramine T, phosdrin, pancreatic extracts
Poultry feed mixers	- - -	Amprolium HCl
Process workers, plastic polymer production workers	- - -	Trypsin, bromelin

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Table 6 - Woods

Occupation		Agent
Carpenters, timber millers, woodworkers	- - -	Western red cedar, cedar of Lebanon, iroko, California redwood, ramin, African zebrawood
Sawmill workers, pattern makers	- - -	Mansonia, oak, mahogany, abiruana
Wood finishers	- - -	Cocabolla
Wood machinists	- - -	Kejaat

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